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Project Management Process for Disaster Recovery Projects

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Project Management Process
for Disaster Recovery Projects

by

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Thesis

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Dedication

This is dedicated to my beautiful parents, wife, and children.

Dad, even though you couldn't be here to see me accomplish this you were always in my heart. I am glad that I finally accomplished something that you aspired for me. You taught me to work hard and to be a great father. I love and miss you dearly.

Mom, you have given me the desire to always go beyond what I am physically capable of doing. I have always enjoyed hearing you say that you are proud of me. You make me proud to be your son.

To my loving wife, thank you for always taking care of every household item while I pursued this masters degree. I know sometimes you were physically and mentally drained, but you never complained and always showed a strong, loving and supporting wife. You are beautiful and I am thankful that you chose me to spend the rest of your life with.

To my three beautiful daughters, you are and will always be the love of my life. I am so glad that God chose me to be your father. I have accomplished so much both personally and professionally, but nothing even comes close to the accomplishment of being your father. I love each of you.

Your son, husband, and father

Steven

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November 2, 2010

Abstract

Project Management Process for Disaster Recovery Projects

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The University of Texas at Austin, 2010

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Abstract: A project is an organized endeavor aimed at accomplishing a specific nonroutine or low-volume task (Shtub, Barb, & Globerson, 2005). Natural hazards particularly hurricanes and flooding do not exactly match this definition, but the recovery from them does. Recovery is not only about restoration of structures, systems and services – although they are critical. A successful recovery is also about the individuals and families being able to rebound from their losses, and sustain their physical, social and economic well-being (Department of Homeland Security, 2010). To be able to do this requires a comprehensive disaster recovery plan comprised of consistent action to be taken before, during and after a disaster.

Flooding and wind related damages from hurricanes and tropical storms create the most widespread natural hazard disasters resulting in billions of dollars in property losses

each year. Southeast Texas is vulnerable to flooding because of its proximity to the Gulf of Mexico and its flat terrain. 2004, 2005, and especially the 2008 hurricane season have highlighted the need for additional guidance, structure and support specifically oriented to long-term disaster recovery. The 2008 hurricane season was particularly active for Texas with a tropical storm and three named hurricanes. Hurricane Ike was the largest to hit the Texas coast in history and the third most destructive in the nation's history. An estimated total damage of $29 billion for the 2008 hurricane season devastated Texas (Office of the Governor of the State of Texas, 2008). Luckily, the recovery efforts for Hurricane Ike have been marked by positive outcomes when compared to previous responses to events, but more work could have been done in the pre-disaster planning of an event. This thesis will outline a process that will look at ways to mitigate the hazard by planning long-term to lessen the recovery time and lead to a more sustainable community by hardening infrastructure and strengthening residential building codes in anticipation of future disasters.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

A project is an organized endeavor aimed at accomplishing a specific nonroutine or low-volume task (Shtub, Barb, & Globerson, 2005). Natural hazards particularly hurricanes and flooding do not exactly match this definition, but the recovery from them does. Recovery is not only about restoration of structures, systems and services – although they are critical. A successful recovery is also about the individuals and families being able to rebound from their losses, and sustain their physical, social and economic well-being (Department of Homeland Security, 2010). To be able to do this requires a comprehensive disaster recovery plan comprised of consistent action to be taken before, during and after a disaster.

Flooding and wind related damages from hurricanes and tropical storms create the most widespread natural hazard disasters resulting in billions of dollars in property losses each year. Southeast Texas is vulnerable to flooding because of its proximity to the Gulf of Mexico and its flat terrain. 2004, 2005, and especially the 2008 hurricane season have highlighted the need for additional guidance, structure and support specifically oriented to long-term disaster recovery. The 2008 hurricane season was particularly active for Texas with a tropical storm and three named hurricanes. Hurricane Ike was the largest to hit the Texas coast in history and the third most destructive in the nation's history. An estimated total damage of $29 billion for the 2008 hurricane season devastated Texas (Office of the Governor of the State of Texas, 2008). Luckily, the recovery efforts for Hurricane Ike have been marked by positive outcomes when compared to previous responses to events, but more work could have been done in the pre-disaster planning of an event. This thesis will outline a process that will look at ways to mitigate the hazard by planning long-term to lessen the recovery time and lead to a more sustainable community by hardening infrastructure and strengthening residential building codes in anticipation of future disasters.

PROGRAM OVERVIEW

In 2008, Texas was affected by three hurricanes and a tropical storm. The impacts to the state were significant, rivaling damage created by the nation's most notorious storms in history and dramatically affecting the economy and infrastructure of the entire Texas coastline. Damage estimates for the 2008 hurricane season totaled more than $29.4 billion in non-reimbursable damage to the state, and it left behind an estimated 32 million cubic yards of hazardous debris (Office of the Governor of the State of Texas, 2008)

The season began with Hurricane Dolly hitting the south Texas coast on July 23 as a Category 2 storm. Two weeks later, Tropical Storm Edouard made landfall on August 2, 2008 onto the upper Texas coast southwest of Port Arthur. Rainfall from Edouard ranged from three to 6.5 inches in Baytown. Within 30 days, Hurricane Gustav hit the Louisiana Gulf Coast on the morning of September 1, 2008 as a Category 2 storm, making landfall near Cocodrie, Louisiana, and swept through portions of east Texas, but with minimal damage.

And, as the governor said, "then came Ike." On September 13, 2008, the third most destructive hurricane to ever make landfall in the United States - with a diameter of approximately 900 miles - struck Texas. Hurricane Ike (Figure 1) slammed the Texas coast at the Houston Ship Channel entrance to Galveston Bay as a Category 2 storm, with wind speeds upwards of 110 miles per hour and maximum tidal surges up to 19 feet. Matagorda, Brazoria, Galveston, Chambers, and Jefferson counties along the coast were significantly damaged, and impacts were seen in a northerly inland direction in a total of 51 counties. The area of greatest impact was a 29-county area where maximum sustained wind speeds varied from 70 to 110 miles per hour. Rainfall totals for the two-day period ranged from 10 to 13 inches.

What makes these storms that much more powerful to handle is the plan or lack thereof of a plan to get the area restored and working together. One plan that was done that proved to be invaluable was the one created by Texas A&M University Galveston. The plan was authored by then President Dr. R. Bowen Loftin. Loftin, now Texas A&M University (College Station)

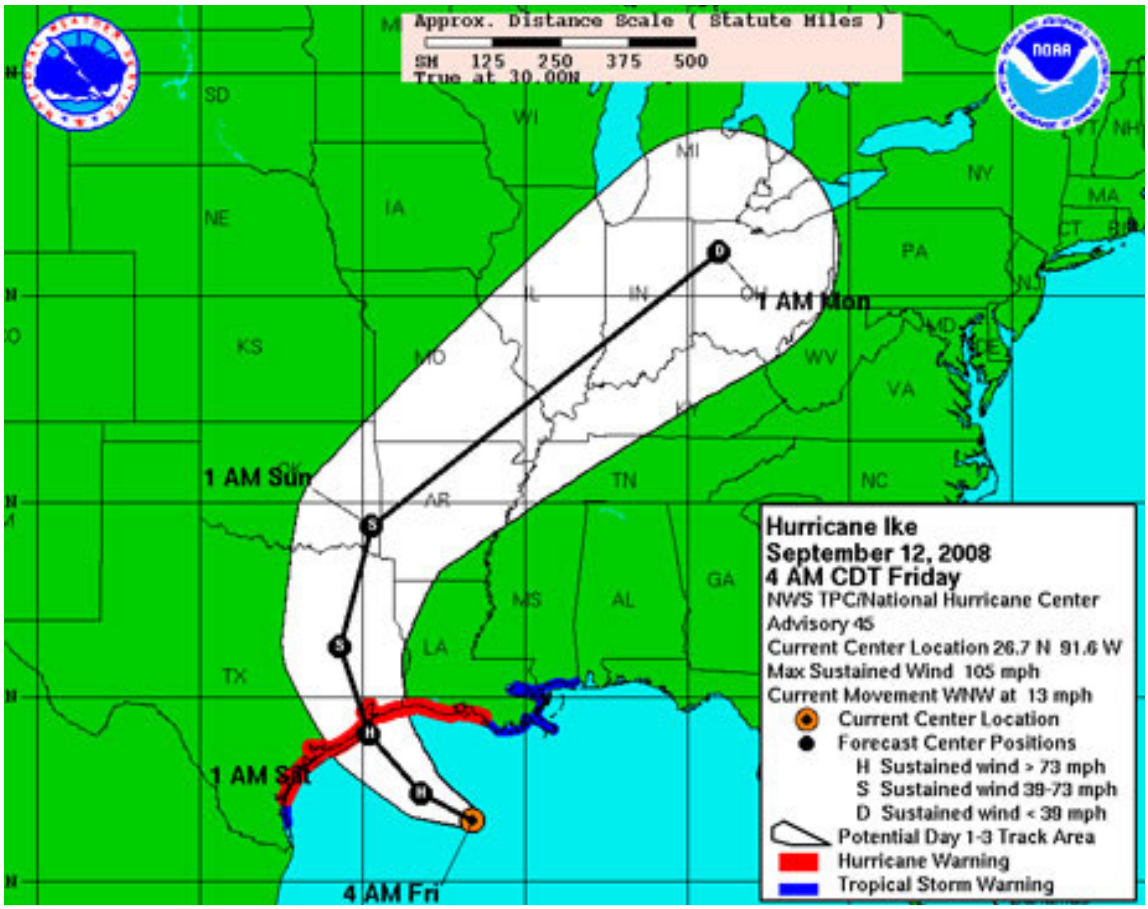

Figure 1: Hurricane Ike Path

(National Ocenanic and Atmospheric Administration, 2008)

President was interviewed by the Texas Aggie, the Official Magazine of the Texas Aggie Network, in May-June 2010 issue (The Association of Former Students, 2010). The following was taken directly from this article and proves how valuable a plan is.

Texas Aggie: On Sept. 13, 2008, Hurricane Ike came through Galveston and caused quite a bit of damage to campus structures and city infrastructure. When students couldn't go back to class, you, as A&M's CEO of the Galveston campus, led the movement of the entire Galveston campus operations to a campus here in College Station. It is a feat still remembered as unprecedented in higher education. Tell me a bit about that day.

Loftin: Well, let's back up because there's a little more to learn about that. I arrived on campus [in Galveston] in late May 2005. The very first day in the office I called my deputy and asked for the plans for hurricane season. He brought two binders in. One binder was a very elaborate process or plan on how you decide to evacuate-what models do you look at? What's your timeline to make your decision to get people off safely? The second binder was a big checklist of how you'd secure the campus-what you put inside buildings and what you took away with you so you minimized the damage if it came close. I asked where the third binder was. Where's the one that tells you what to do if the hurricane does hit you? They didn't have one. That year you may recall we had two hurricanes. Katrina never threatened us directly, but when Rita was coming close, I was in College Station for my weekly meetings. I talked to Bob Gates about needing to possibly evacuate. He said "Bowen, have you ever thought about what would happen if you couldn't return to campus because of hurricane damage?" He said we should really consider thinking about bringing our students here. The rest of that week we spent working as a team of Galveston and College Station people to put together a quick plan to bring people here if we had to. It turns out Rita went to the east of Galveston, we had minimal damage and not much was required. But we went back to Galveston and finished the plan. The background is important to have.

Fast forward now to 2008. We had Ike coming in and it looked pretty bad to me. We were watching it very closely and the models were shifting all the time. So we shut down the school on Wednesday at 2 p.m. and everybody was gone by 5 p.m. Ike came right over the campus on Saturday at 2:10 a.m. Though the campus itself was not heavily damaged in terms of major buildings, the city of Galveston was devastated. It appeared to me that it was going to take probably at least a month or two to get services back to the campus and housing for our students.

Our rule at that time was that if we can't get back in class within two weeks, we'd come to College Station. So Saturday morning at 2:10, Ike came across Galveston and on Sunday, I made the call to bring us here. If we couldn't have recovered the semester, the students would

have missed out. They wouldn't have been able to graduate when they wanted to and they'd be off track. They wouldn't be where they wanted to be. So it was essential that we get that done. We got about 2,000 people moved here and going again in about two weeks. The point was the obligation to the students. We had to get them into class.

This summary of what Dr. Loftin and his staff did after Ike is Project Management at its best. A project is an organized endeavor aimed at accomplishing a specific nonroutine or low-volume task (Shtub, Barb, & Globerson, 2005). Natural hazards particularly hurricanes and flooding don't exactly match this definition, but the recovery from them does. What happened at Texas A&M Galveston was:

- An organized endeavor – Dr. Loftin and his staff put together a plan to get the students functional again if a hurricane impacted the university.
- Aimed at accomplish a specific nonroutine or low-volume task – Galveston gets brushed or hit by a hurricane every 2.96 years. (Hurricane City.com, 2010). Thus, the volume of this event is not daily, monthly or even yearly, so it would qualify for a "nonroutine or low-volume task"

The effort sustained by Dr. Loftin and his staff at Texas A&M Galveston, the Governor's Division of Emergency Management (GDEM), and the Office of Rural Community Affairs (ORCA), all were efforts that allowed the state of Texas to have a disaster response that was immediate and effective. ORCA was the lead agency to administer the Community Development Block Grants (CDBG) funds from the United States Department of Housing and Urban Development (HUD) for non-housing activities leading to recovery. ORCA partnered with the Texas Department of Housing and Community Affairs (TDHCA) to bring together a program that rebuilt damaged infrastructure and housing.

The Texas Office of Rural Community Affairs (ORCA), the governor's lead agency for administering non-housing Community Development Block Grant (CDBG) disaster recovery funds, made significant progress in the recovery effort shortly after the September 13, 2008 landfall. Progress that surpassed Hurricane Rita timeframes by three months provided technical

assistance to non-entitlement communities that helped them move towards normalcy in an effective manner, fostered collaborative partnerships that have focused on recovery results, and maximized resources for recovery.

Hurricane Ike affected almost 35% of the Texas population, 51-counties, and 46,000 square mile disaster area. The hardest hit were the 167 non-entitlement communities, which span 29 counties in Southeast Texas, that ORCA helped in identifying, assessing, scoping and estimating infrastructure projects for Hurricane Ike Recovery seen below (See Figure 2).

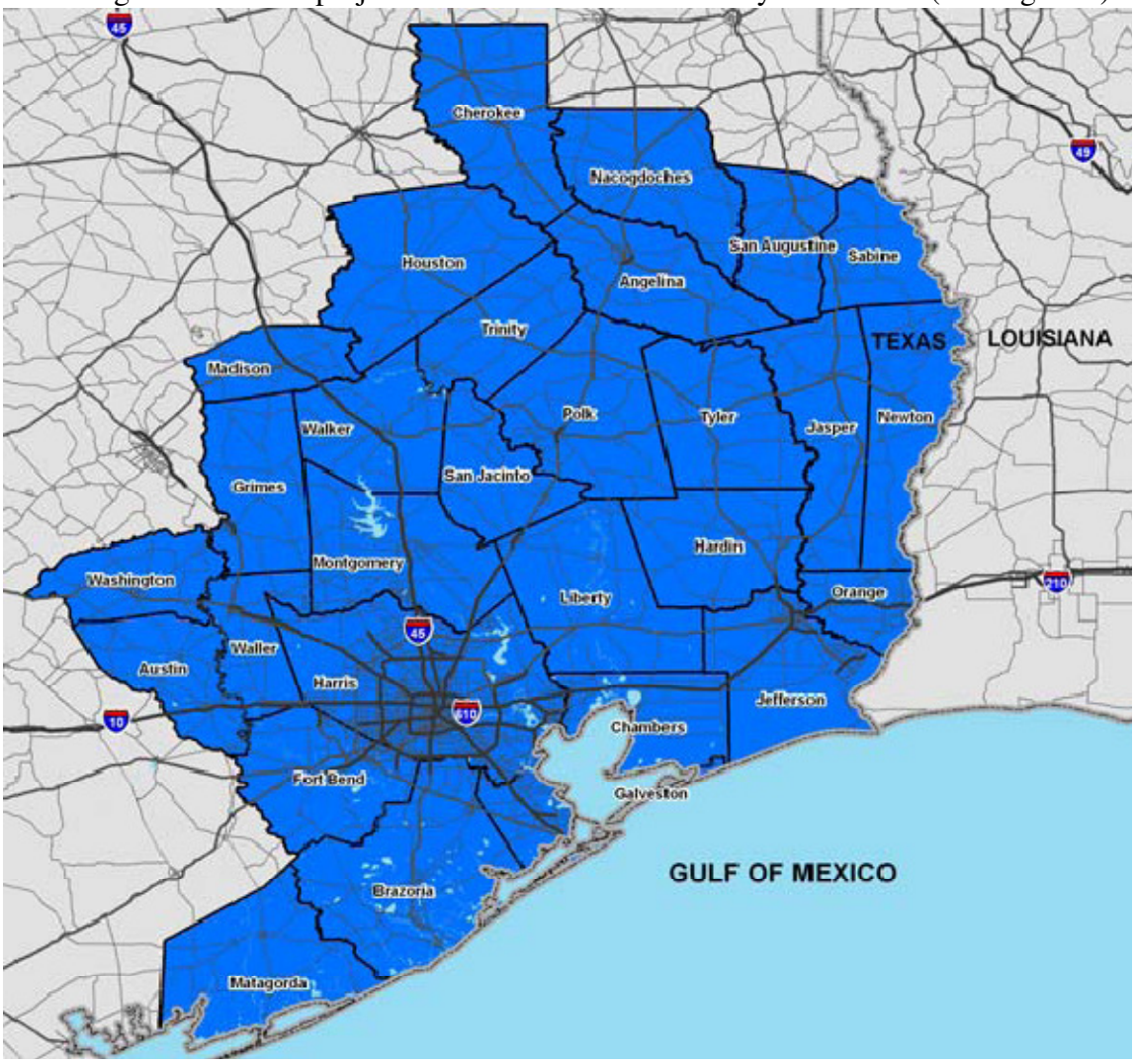

Figure 2: Hurricane Ike Affected Area

This effort included more than 350 public meetings, over 3,650 projects identified, and 2,700 projects assessed, scoped and estimated in the compressed timeframe of November 2008 to May 2009. The assessed projects are estimated to reflect over $2.8 billion in total costs. The Hurricane Ike Recovery Program goals were to:

- Maximize U.S. Department of Housing and Urban Development (HUD) funding to Texas for Hurricane Ike Recovery efforts
- Assist rural communities affected by Hurricane Ike to identify, prioritize and implement sustainable improvements and essential development for these rural communities
- Shorten the time required to provide recovery and improvements that are critical to the affected communities
- Serve as the advocate for the affected communities
- Simplify and standardize the approach for hurricane recovery funding applications

ORCA achieved a considerable amount of recovery during a short timeframe with limited resources. By moving forward as rapidly as possible, ORCA identified and justified resource needs for infrastructure through HUD, FEMA and other sources in a way that provided for solid community recovery.

Chapter 2: Research Methodology and Approach

The author was one of the first boots on the ground and led a team of field assessment engineers to complete damage assessments of infrastructure and residential structures in Southeast Texas impacted by Hurricane Ike. These services included performing Residential Substantial Damage Estimates (RSDE) within the City of La Porte, and assessment of impacted infrastructure including building, water/wastewater, drainage and transportation facilities within 29 counties in Southeast Texas. Hurricane Ike occurred on September 13, 2008 and the author was located in Southeast Texas from the last week of September 2008 to approximately May 2009. It was during this time that it was clear that a more defined Project Management Process was needed to adequately assess the infrastructure to ultimately lead to recovery.

The author decided that further investigation was needed to adequately define a Project Management process that had been started for Disaster Recovery Projects. Thus, the author interviewed well known engineering leaders from a company that has extensive experience with FEMA recovery programs including Individual Assistance (IA), Public Assistance (PA) and all of FEMA's mitigation programs. These engineering managers have more that 35 contracts with FEMA covering these programs over the past 20 years. Their experience covers more than 15 presidentially declared disasters in Texas including four in the Southeast Texas region.

Four interviewees were chosen that had a variety of experience and our listed below.

- Interviewee A is a nationally recognized expert in disaster response, recovery, and mitigation with 30 years of experience. He has direct experience with FEMA's Public Assistance, Individual Assistance, Housing Inspection, and Mitigation Programs. He is responsible for assigning projects, monitoring project budgets and schedules, and providing technical assistance and review for all Disaster Recovery projects.
- Interviewee B was appointed by President Clinton as the Federal Insurance Administrator (FIA) with the Federal Emergency Management Agency after Senate

Confirmation in March 1998. She was responsible for managing more than $500 billion of flood insurance with the National Flood Insurance Program.

- Interviewee C has over 15 years of experience in the areas of emergency management planning, hazard mitigation, and disaster recovery. He has been involved in hazard mitigation policy and program development, unmet needs and Community Development Block Grants (CDBG) program implementation, risk assessment and cost-benefit analysis, mitigation planning, disaster recovery planning, housing recovery program development and implementation, risk perception and communication outreach.
- Interviewee D has over 34 years of professional experience in water resources including project management; riverine hydrology and hydraulics; post-disaster data collection; FEMA substantial damage determinations, NFIP compliance, flood loss estimation; and flood mitigation

All interviews were conducted on the phone and generally lasted 10-20 minutes. The questions were simple: 1) have they ever seen or used a defined project management process for a disaster recovery project and 2) which measures would they recommend to lead to a successful disaster recovery effort. These two questions related to how process was established and to personal experiences that could help in a disaster recovery effort.

RESEARCH FINDINGS

All four interviewees answered the first question of "had they ever seen or used a defined project management process for a disaster recovery project" the same way. Even though that may have had a project management process at their companies they had never used or seen a defined project management process for disaster recovery projects specifically. For the second question, "which measures would they recommend to lead to a successful disaster recovery effort", all had essentially the same message. Each said to "Pay special attention to how you accomplish your site assessment because that is the foundational element to the

success of recovery from a disaster." After the 10-20 minute interviews, notes were gathered and findings were summarized. The authored combined the notes from the interviewees with those of his own experience and each interviewees was contacted a second time to make sure the findings were adequately represented. These findings, verified by the interviewees and the personal experience of the author, will lead to the Project Management approach for Disaster Recovery Projects outlined in this thesis. The three-phased approach for the foundational element of the assessment phase is below:

- Phase 1: Setup of Assessment Operations
- Phase 2: Assessment Operations
- Phase 3: Completion of Assessment

Phase 1: Setup of Assessment Operations

Recruitment of Additional Needed Staff & Partners

The Project Manager (PM) of the Disaster Recovery Project (DRP) must have the resources to cover all technical aspects required to meet the demands of the disaster. However, with the uncertainty of the type, magnitude and impact of the disaster, there may be a need to add additional staff or partners to complete the site assessments.

Implement training before the disaster to ensure current and future staff resources have the necessary skills and knowledge to efficiently complete the required damage assessment. Training should be completed for the following programs for FEMA

- Substantial Damage Estimator (SDE)
- Public Assistance Operations including the development of Project Worksheets
- Debris Operations
- Benefit Cost Analysis
- Hazard Mitigation Assistance Grant Development

Obtain Data on the Disaster (i.e. path of the storm, level of flooding, area affected)

Utilize the numerous resources available to gather data to forecast the magnitude of the disaster before it actually occurs. Get the aerial imagery and orthophotography from sources within the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Homeland Security (DHS) and the U.S. Army Corps of Engineers (USACE) to the decision makers as quickly as possible to assess the situation.

Finally, in advance of disaster specific data availability, the project team should do a disaster specific analysis to develop preliminary disaster damage and impact information.

To summarize, Table 1 below shows the data sources that can be contacted or accessed and the types of information that can be gathered from each source

Data Source	Information To Be Collected
FEMA IA Program	Residential damage data and aid distributed through the IA program
FEMA PA Program	Infrastructure damage data and aid distributed through the PA program
FEMA NFIP	Flood Insurance Claims Data
FEMA Mitigation	Planned mitigation strategies and priorities
DHS/FEMA/NOAA	Remote sensing data including satellite and photogrammetric imagery to assess disaster impact
Economic Development Administration	Community economic data and information on expected economic impacts of the disaster
FHWA	Damage data and aid distributed for Federal Aid highways
USGS	Gauge information
NOAA	Tide and weather data
USACE	Damage data and structure inventory information
Census Bureau	Demographic and statistical data
County	Parcel and historic GIS information, public infrastructure

	information, historical damage data.

Table 1: Funding Sources

Plan Focus Group

In order to effectively conduct post-disaster damage assessments, the community must be engaged early in the process. This is especially critical in the following sectors, housing, infrastructure, community facilities, businesses, utilities, and transportation that must quickly be reinstated once a disaster strikes. Planning and conducting these focus groups with key stakeholder groups will strengthen the disaster damage assessment process.

Key activities include:

- Schedule the session (plan for a maximum 2-hour session)
- Confirm participant attendance
- Secure meeting room
- Prepare agenda and establish focus group ground rules
- Finalize questions
- Arrange for note taker, refreshments, and discussion documentation (preferably videotaping)

Conduct Educational Meetings on Assessment Process

Educational outreach meetings that are well planned and effectively carried out will help stakeholders to better understand the importance of the assessment process and the value that it brings to the community in a post-disaster setting. Going through these meetings will lead to an important outcome of targeted education and outreach initiative. To do this, the PM must:

- Develop a key message platform. Have a set of three to five high-level key messages that will be used in all communications regarding the damage assessment process and subsequent long term community recovery initiatives.

- Prepare educational outreach action plan. An action plan that defines communications goals and objectives; target audiences, key messages, specific activities associated with planning and executing the educational outreach meeting.
- Conduct educational outreach meeting. These meetings will give local community leaders, interest groups, and other stakeholders the confidence that everyone is informed and able to provide accurate information about the damage assessment process to their constituents.

Phase 2: Assessment Operations

Conduct survey of damage to housing and non-housing community elements

Conduct the damage survey in a consistent and high quality manner. This means that teams must be trained and briefed before the disaster hits. Walk through the process with the teams and show them the manner on how the assessments will be completed. Do this with worksheet templates in hand to train the teams what to look for in assessing the damages. These worksheets could be similar to the ones found in Appendix 1 that go through the different infrastructure with the type of damages most commonly found.

Phase 3: Completion of Assessment

Development of Draft Documents for Review and Approval by impacted Municipality(ies)

Employ established standards when developing draft documents and supporting materials for the Damage Assessment deliverable. These documents are data-rich and it is important to develop early on database templates for arraying the information collected as part of the Damage Assessment.

Once the Damage Assessment is complete, place in a form that will be utilized to secure grants and other sources of State and Federal funding that will aid in the community's recovery process. Also important would be able to provide a document that will help in mitigation planning and recovery efforts that will better ensure a more sustainable community for future disasters.

Chapter 3: Process Approach to Project Management

DEFINING RECOVERY AND TIMEFRAME

Going through the devastation caused by a hurricane and knowing a defined process is in place with all project stakeholders makes all the difference between life and death. Project stakeholders are the individuals and organizations that are actively involved in the project, or whose interest may be affected as a result of project execution and project completion (Project Management Institute, 2004). They are also partnerships in the process that are imperative for ensuring that all parties are heard that are involved in the disaster recovery. This is especially critical at the local level, where non-governmental partners in the private and non-profit sectors (i.e., local businesses, owners and operators of critical infrastructure and key resources) play a significant role in meeting the needs of those less fortunate. A Quick Start program can be that functional component that defines the process and stakeholders to understand the critical priority needs to get a community functional again. Is this Power, Sewer, Water, Housing, Emergency Operations? Every storm and the sustainability of the damages it leaves behind are different. So the first step in creating a working Disaster Recovery Plan is to define what "Recovery" means to the community that is impacted by a hurricane. Answering this question will allow the decision tree to be formulated on what will be worked on first.

As disaster response slows down, recovery activities become primary. Recovery is a 3 phased approach involving stabilization, intermediate recovery activities, and long-term recovery (Department of Homeland Security, 2010). Stabilization is the process in which the immediate impacts of an event on community systems are managed and contained, thereby creating an environment where recovery activities can begin (Department of Homeland Security, 2010). Stabilization recovery related to operational infrastructure includes such activities as:

- Providing congregate sheltering or other temporary sheltering solutions
- Developing impact assessments on critical infrastructure, essential services, and key resources

- Conducting initial damage assessments
- Conduction community wide debris removal, including clearing of primary transportation routes of debris and obstructions
- Restarting major transportation systems and restoring interrupted utilities, communication systems, and other essential services such as education and medical care

(Department of Homeland Security, 2010)

Intermediate recovery activities involve returning individuals and families, critical infrastructure and essential government or commercial services back to a functional, if not pre-disaster state (Department of Homeland Security, 2010). Recovery related to getting infrastructure operational includes activities such as:

- Establishing a post-disaster recovery prioritization and planning process
- Developing an initial hazard mitigation strategy responsive to needs created by the disaster
- Ensuring that the local critical infrastructure priorities are identified and incorporated into recovery planning

(Department of Homeland Security, 2010)

Long-term recovery is the phase of recovery that follows intermediate recovery and may continue for months to years. Examples include the complete redevelopment and revitalization of the damaged area. The goal underlying long-term redevelopment is the impacted community moving toward self-sufficiency, sustainability and resilience (Department of Homeland Security, 2010). Activities may include:

- Identifying of risks that affect long-term community sustainment and vitality
- Developing and implementing disaster recovery processes and plans, such as a long term recovery plan and/or reflecting recovery planning and mitigation measures in the community's land use planning and management, comprehensive plans, master plans, and zoning regulations
- Implementing mitigation strategies, plans and projects

(Department of Homeland Security, 2010)

Another important factor in Disaster Recovery is the aspect of timeframe. Does the infrastructure that got damaged need to be fixed in a day, week, month or year? Do you bring up one key infrastructure system up or do you wait till you have more restoration to other critical infrastructure items before you allow residents back? Determining the Recovery Time (RT) from one infrastructure system over another before the disaster event, can all be done in the Project Management Process of Disaster Recovery.

A Disaster Recovery Planning (DRP) project cannot be completed in a week or even a month. In many ways, a DRP is never completed. The plan must be tested and updated at a time interval to avoid the plan being antiquated. The Plan must keep pace with the changes in the city/county/state infrastructure, development, and population density.

Virtually all disasters are experienced at the local level, where many communities can expect to be "on their own" for the first seventy-two hours after disaster impact (O'Leary, 2004), thus these local governments have the primary responsibility to play the lead role in planning for and managing all aspects of disaster recovery. Therefore, the principle objective of a DRP is to guide the municipality in the event of the disaster and to make operational critical municipal infrastructure within the shortest possible period of time with a minimal loss of functionality. The goals of the planning project is to assess current and anticipated vulnerabilities and define the requirements of the municipal government structure to create a plan that will allow quick and efficient reaction at the time of the disaster. It is this planning that will avoid the situation too often experienced by many local municipalities where they are waiting for the call from the national or state government, but rather taking a proactive approach to respond to lead to a successful recovery. Once this leadership is established at the local level, then other shared responsibilities from all levels of government, individuals, families, businesses, and community organizations can be established.

PROJECT MANAGEMENT ACTIVITIES AND WORKFLOW

The first goal in Hurricane Recovery is to identify, assess, scope, and estimate the recovery project. This is done to establish the full budget of what it is going to take to recover. Only after this budget is set and funding is allocated for the recovery, can the design and construction schedules be outlined. Without a full understanding of what it is going to cost and where the money will come from, the recovery process will be stalled. After the budget and funding are completed, design and construction schedules can be set to determine the ultimate timeframe for recovery.

The Project Management standard describes the nature of project management processes in terms of the integration between the processes, the interactions within them, and the purposes they serve (Project Management Institute, 2004). A process in Project Management is defined as a sequence of steps that should be followed to execute a task (Forsberg, Mooz, & Cotterman, 2000). These processes are aggregated into five groups, defined as the Project Management Process Group:

- Initiating Process Group (Define and Organize)
- Planning Process Group
- Executing Process Group
- Monitoring and Controlling Process Group
- Closing Process Group

Initiating Process Group (Definition Phase)

The Initiating Process Group consist of the processes that facilitate the formal authorization to start a new project or a project phase (Project Management Institute, 2004). This is the process where you figure out what the project's high-level goals are. Establishing the project organization is a goal that must be known at the beginning of a DRP. These are:

- Establishing the project organization
- Define the project parameters

- Define the project framework
- Assemble the project definition document

(McCann, B., 2009)

Establish the Project Organization

A key component to any project is deciding who the Project Manager is. The Project Manager does not need to be an expert on everything, but they must focus on managing the different processes and empowering the team to do their work. An effective project manager on a DRP must make timely adjustment to the project management plan, track issues, resolve conflicts, manage project scope, manage risk, document and communicate, and behave ethically (Project Management Institute, 2004). After the Project Manager is chosen, a linear responsibility chart (LRC) should be developed that clearly outlines all of the authorities and responsibilities of the project participants and their roles. An LRC is important because it allows each project participant to understand their specific involvement, understand the involvement of others and ensures that all work is "owned." The codes used in a LRC are:

P=Primary Responsibility (does the work)

B=Initiates

A=Approves

R=Reviews

I=Provides input to

O=Receives output of

N=Is notified of

Table 2 shows an example of a Linear Responsibility Chart below. The chart goes through some key tasks, but please note that this is not an exhaustive lists of tasks associated with a Disaster Recovery Project.

	PM	ENG/IT	WW/W	DRNG	BLDG	TRANS	PR
Meets with Community	P						B

Officials							
Obtain overview of disaster area and extent of damages	P						B
Recruit Additional Staff & Partners	P						
Setup public meetings	P						B
Develop key message platform	A						B,P
Setup assessment operations	P						
Setup schedule	P	N	I	I	I	I	
Perform Assessments	R, A	O	P	P	P	P	B
SharePoint Setup	A	P					
Daily Reports	A	O	P	P	P	P	
Upload data to website and SharePoint site	A	P					
Research funding opportunities for disaster recovery efforts	A	P	I	I	I	I	
Overall Quality Control	P						
Final Deliverable Report	A	P	R	R	R	R	P

Table 2: Linear Responsibility Chart

Define the Project Parameters

"Perhaps the most important element of any project plan is knowing its objectives and deliverables. The Define the Project Parameters step ensures that energies are expended on the 'right' project, defined in terms of expected outcomes or scope, schedule, and allocated resources"(Harvard Business School, 1996). Some key questions that should be answered during this phase are:

- What are the business benefits of the project?
- When will the project be completed?
- What resources are allocated to the project?
- What are the project's key milestones?
- Are the milestones clearly defined?
- When are the milestones scheduled?
- What are the major risks?

Answering these questions will allow the Project Manager to create a Project Objective Statement (POS). The POS is clear (uses plain language, avoids jargon and acronyms), concise, and visionary (McCann, B., 2009). A Project Objective Statement for a DRP would include scope, schedule and resources. An example could be:

- Scope: the desired results
    - "Provide disaster recovery efforts to Community and sustain improvements to withstand future disasters"
- Schedule: the desired completion date
    - "Within 6 months after disaster"
- Resources: the desired total costs
    - "At a cost to the community of $1 million plus additional grant funding available"

Defining what the project is and is not, as well as the risk involved with the project is an important step in this phase. The IS/IS NOT list will determine key items that are included (is) and excluded (is not) in the project.

IS/IS NOT LIST

Deliverable: Disaster Recovery Report detailing engineering design, schedule and budget for the community to recovery from Hurricane ___ and sustain improvements to harden the infrastructure from future disasters

IS

- Report detailing infrastructure damages from Hurricane
- Preliminary engineering design, schedule and budget for infrastructure recovery

IS NOT

- Final engineering plans, scopes and estimates for the infrastructure replacement
- All inclusive document of all funding sources available to recover from Hurricane Disaster

Also during project definition, it is helpful to make a short list of the most significant project risk. You should consider both the probability of occurrence and the impact if it does occur. Knowing what the project is and is not with the risk involved in doing the project will be helpful in developing risk management plans in later phases of the project.

Define the Project Framework

Defining the Project Framework will show how the project team will operate in:

- Meetings. Need to document time & place, agenda, and how the discussion will be organized. For example:

    - During site assessment, hold meeting every evening to discuss progress and outstanding issues. Document how that is going to be accomplished, where is it held and what will be discussed.
    - During scoping and estimating, hold weekly meetings to discuss progress and outstanding issues. When will subject matter experts get involved in the process, etc?
- Decision process. Should be as unilateral as possible, with the project manager having the ultimate decision, but also task leaders playing a major role in deciding how the individual task items are handled.
- Issues management. Issues are risks that have occurred and they need to be handled immediately by the project manager, task manager, or other as defined by the Project or Task Manager. The issues need to be logged and maintained by the project manager with each issue having:
    - An originator
    - An owner – responsible for resolution
    - A due date
    - A status – open or resolved Issues management. Issues are risks that have occurred and they need to be handled immediately by the project manager, task manager, or other as defined by the Project or Task Manager. The issues need to be logged and maintained by the project manager with each issue having:
- Project file. Need to contain all formal project documents, meeting minutes, etc. Can be physical or online and should be available to the entire team.
- Communication management. Need to determine and plan for the information and communication needs of the stakeholders. Who needs what information? When? How will it be delivered? By whom? A DRP manager must be able to support clear, consistent, culturally sensitive and frequent communication of key recovery information to the public and stakeholders. With this clear communication, the general public and

stakeholders will understand their roles and responsibilities and be able to have a realistic understanding of the recovery process and goals.

Assemble the Project Definition

This is the final step in the Definition Phase of the project. This is essentially the deliverable for this phase and includes:

- Project objective statement
- Major milestones with target dates
- Linear responsibility chart
- Project roster
- Major risks list
- Project framework
- Is/Is Not lists
- Project Announcement

(McCann, B., 2009)

This deliverable is a formal document that is distributed to all project team members and will be referenced when any key decision need to be revised or changed altogether. This document is also called the Statement of Work (SOW). An example Statement of Work for a DRP could be:

- Major Deliverables
    - Assess water/wastewater, transportation, drainage and building infrastructure in community damaged by Hurricane
    - Prioritize and implement sustainable improvements to harden the infrastructure systems for future disasters
    - Shorten the time required to provide recovery and improvements that are critical to the affected community

    - Serve as an advocate for the affected community
- Supporting the deliverables
    - Maximize governmental funding for recovery efforts
    - Utilize state of the art assessment software to document assumption, calculations and data
- Resources needed
    - Subject matter experts in the field of water/wastewater, drainage, building, transportation and electric
    - Field personnel trained in the operation of worksheets and software for infrastructure assessment
- Deliverable date
    - 6 months after notice to proceed (preferably within 3 days of disaster)

Planning Process Group

The Planning Process Group is where you identify, define, and mature the project scope, project cost, and schedule the project activities that will be occurring during the project (Project Management Institute, 2004). In other words, this is where you figure out how you will get all the work done. Steps for the DRP in the Planning Process include:

- Develop the Work Breakdown Structure
- Develop the schedule
- Develop a risk management plan
- Analyze resources
- Optimize tradeoffs

(McCann, B., 2009)

Work Breakdown Structure

"The single greatest source of project delays is work that is inadvertently forgotten or omitted. A credible project plan accounts for every task required to achieve the objective. The

Work Breakdown Structure (WBS) step systematically accomplished this." (Harvard Business School, 1996). The WBS is a tool to display the work to be executed by the project team, to accomplish the project objectives and create the required deliverables. The WBS organized and defines the total scope and subdivides the project work into smaller, more manageable piece of work. For a DRP, a detailed WBS should include four major program activities:

- Project identification
- Field assessment
- Scoping and Estimating
- Report preparation

A subset of those four major program activities should also include other activities such as:

- Community meetings and outreach
- Public involvement
- Environmental screening
- Document controls
- Development and implementation of technology tools such as a project progress tracking web-based program such as dashboard and a public Web Site
- Quality Assurance/Quality Control (QA/QC) program
- Funding coordination with local, state and federal agencies to facilitate the recovery efforts and maximize funding to the communities

The Project Identification and Field Assessment program activities are critical first steps in the Recovery Project. These steps determine which infrastructure projects are identified and field assessed. Completing this may require contacting the regional Council of Governments (COGs), counties, cities, water and wastewater districts, and local emergency officials (Police, Fire, Ambulance, Emergency Responders) and determining what failed or "failed to function" due to the Hurricane. With most Disaster Recovery Programs, an infrastructure project is eligible to receive funds if the project meets the following criteria:

1) It received damage(s) as a result of the Hurricane. An example could be a submerged road, damaged bridge, submerged pump or lift station, collapsed building.
2) It failed to function as a result of the Hurricane. Examples of this includes power failures that made lift stations, pump stations, building facilities non-operational, a community shelter that was at capacity and could not fulfill all the needs, or a water or wastewater system that lost pressure due to the storm.

The critical question "Did it fail" or "Did it fail to function" are key components to determine the candidate projects within communities. A pilot site assessment should be completed to understand the following:

- Challenges of how to assess the projects
- Time constraints in assessing the projects
- Questions to ask the community on the infrastructure damage

After the pilot project is complete, a complete set of assessment worksheets should be developed for public buildings, water/wastewater, drainage, and transportation facilities. These worksheets have questions to determine the severity of the damages or failure to function of the infrastructure. Examples of the type of projects are included in the Appendices (Office of Rural Community Affairs, 2009).

In a DRP, the Project Manager and the whole Project Team must be made aware that communication is the key to success to recovery efforts. Thus, communication is a key work item and should be represented in a WBS. Disaster operations differ by disaster level and therefore the Project Team must present a multilayered, multi-topic, subject matter expert approach depending on the size of the disaster and the level of communication necessary. Subject matter experts (SME) will be needed to cover any level of communication required for any level of disaster or multiple disasters. Typically, the SME's needed for the disasters are in the field of Public Relations, Transportation, Drainage, Water and Wastewater, Building, and Power. Having these experts with years of learned experience will instill confidence with the public and their public officials that the team knows what they are doing.

After the communication project team is set, then the focus must be turned to who is the primary Public Emergency Management Official. In Texas, this is usually the County Judge for the County setting or the Mayor in the City setting. It is this Public Official that will be the primary public face of a disaster response for the length of the contract. It is also anticipated that in the event of a disaster, the Public Official (Judge/Mayor) will appoint someone to be the primary point of contact; this person will be the Public Information Officer (PIO) and will be the primary point of contact in daily briefings from the Project Manager. The PIO will also be supported by technical and briefing support from other key departments from the affected municipalities). The Project Manager must support the Judge/Mayor, PIO and his entire team to give the most accurate and timely information available. This can be done by the utilization of a Web-based SharePoint Database that can hold Daily Reports complete with statistics on the extent of damages, number of displaced, and possible cost estimates for remediation of the damaged areas. It must be the Project Managers' objective to answer any questions that might arise the same day as asked.

The Project team needs to be prepared to support all layers of the local government management, Federal, State and Local Officials, and the pubic as required by contracting municipalities. Depending on the recommendation of the PIO, the members of the Project team can be called upon to provide "behind the scenes" or "on camera" briefings as subject matter experts. It is also important to have diverse team members to give briefings in multiple languages if the need arises.

The primary single point of contact with the municipality is the Project Manager. The Project Manager must determine the level of expertise needed and once determined, the following subject matter experts will communicate the information needed directly or to the individuals within the municipalities designated to perform the briefings or presentations. A detailed communication plan must be coordinated and accepted between DRP professionals and municipalities before work is started to understand how the process will be done and maintained.

The Project Manager will also be the single point of contact if questions arise about Assessment Operations and will field communications with local officials, Mayors, City Managers, Public Works officials and any other key staff.

Develop the schedule

Project scheduling deals with the planning of timetables and the establishment of dates during which various resources, such as equipment and personnel, will perform the activities required to complete the project (Shtub, Barb, & Globerson, 2005). The schedule is used to answer questions such as:

- When will the project be complete?
- When will specific resources be required?
- Which tasks are most critical to on-time completion?
- Which tasks can be delayed and by how much?
- Can completion be accelerated?

These questions can only be answering by knowing the scheduling inputs. The scheduling inputs are:

- A list of all project tasks
- The estimated duration of each task
- Precedence constraints among tasks

An example schedule of the site assessment phase of a Disaster Recovery Projects is found on the next page.

PROJECT SCHEDULE

	MONTHS																							
	1				2				3				4				5				6			
Phase 1: Setup of Assessment Operations																								
Recruitment of additional needed staff and partners	■																							
Obtaining data on disaster (i.e. path of storm, levels of flooding, areas affected)	■	■																						
Plan survey of damage to housing and non-housing community elements			■																					
Plan focus group				■																				
Conduct educational meetings on assessment process				■																				
Phase 2: Assessment Operations																								
Conduct survey of damage to housing and non-housing community elements					■	■	■	■	■	■	■	■												
Facilitate focus group and additional educational meetings											■	■	■	■										
Obtain FEMA and SBA data on housing damage, non-housing damage and individual assistance within County									■	■	■	■	■	■	■	■								
Phase 3: Completion of Assessment																								
Publish final approved Damage assessment document in bound and digital format													■	■	■	■	■	■	■	■				

Table 3: Project Schedule

Develop a risk management plan

"Devoting a small amount of attention to risk management will provide an improved chance of meeting schedule and budget targets." (McConnell, 1997) Understanding the risks associated with DRP is paramount to a successful project. With advance planning you can avoid crisis and be proactive in designing a plan to deal with risk. With DRP, the risks are usually seen with the number of projects (sites) and to what extent the damages are seen. For example, with the 2008-2009 Hurricane Ike Disaster Recovery Program, it was estimated that 960 projects would be assessed and the damages were going to be extensive. After a few weeks on the job, it was apparent that the number of projects (sites) that needed to be assessed was well over 2000 and the damages were mostly seen as a lack of power. In the 29 county regions that were studied, most of the damages was wind related and caused power outages within these communities including outage to key infrastructure in shelter facilities, lift and pump station and treatment plants. Generators comprised over half of the assessed projects and special consideration was given to ensure that the generators recommended for the infrastructure reflected a high-quality unit capable of extended operation in adverse weather events. Thus, if the project scope is tightly defined on the number of projects (sites) and the level of damages, you may be faced with the internal non-technical risk of cost over runs due to project scope. To avoid this risk and others, the PM on a DRP should define risks within two categories, Uncontrollable and Generally Controllable. Some examples of the risk in these two categories are found below:

- Uncontrollable
    - External Unpredictable – Such as regulatory or unanticipated government intervention, environmental, or financial such as loss of funding.
    - External Predictable – Such as market prices changes and operational changes.

- Generally Controllable
    - Internal Non-Technical – Management deficiencies or turnover, schedule delays, cost over runs, cash flow problems.
    - Internal Technical – Changes in technology, performance progress, technology let-downs and massive project size operations.
    - Legal – Licenses, contractual difficulties, lawsuits, and force majeure

Analyze resources

Knowing which resources to use, from what sources you are using them, and when and how to use them is effective resource planning and it is key to the success of a DRP. The resources in a DRP are skilled staff in the different specialty fields of infrastructure services such as Water/Wastewater, Drainage, Transportation and Building Facilities. After a disaster event, it is critical to know not only the extent of the damages, but what infrastructure got damaged and what specialty staff would be needed to assess it, re-engineer it and get it back operational as quickly as possible. Hurricane Ike was mostly a wind driven event causing numerous power outages throughout the affected areas. Thus, it was clear that an engineer with generator experience was going to be needed to assess the power needs of the different damaged infrastructure. These included lift stations, building facilities, and treatment facilities. In many cases, the infrastructure was operational once power was restored. In other DRP, the project manager and team may be faced with an event that is more surge or flood inundation driven. This would cause damages such as flooded roads, pavement structures, channels, and bridge washouts. Therefore, it must be known what type of damages were incurred before your resources are assigned to the project. A technique called "Resource Leveling" is any form of schedule network analysis in which scheduling decisions (start and finish dates) are driven by resource constraints (Project Management Institute, 2004). For example when you have limited resource availability or difficult-to-manage change in resource availability level you can utilize

this tool. This tool is especially effective in disaster recovery projects because resource staff is usually office outside the project area and you don't want to release them only to have them ask for them back at a later date, incurring multiple travel cost and lost productivity time.

You should rather lay out the activity, predecessors, duration, and number of staff needed to have a clear understanding of when you need staff and how long you are going to need them. A generic example of resource leveling is seen below.

Resource Leveling Example

Activity	Predecessors	Duration	Staff
Wastewater	_	2	1
Water	_	3	3
Drainage	Wastewater	4	3
Transportation	Wastewater, Water	4	4
Facilities	Water	3	4
Generators	Drainage	4	6
Storm Sewers	Transportation	1	1
Bridges	Generators	3	4
Utilities	Generators,Storm Sewers	5	6
Coastal areas	Bridges	3	2

Leveling Example
Early Start

	Week															
TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Wastewater	1	1														
Water	3	3	3													
Drainage			3	3	3	3										
Transportation				4	4	4	4									
Facilities				4	4	4										
Generators							6	6	6	6						
Storm Sewers								2								
Bridges											4	4	4			
Utilities											6	6	6	6	6	
Coastal Areas														2	2	2
TOTAL	4	4	6	11	11	11	10	8	6	6	10	10	10	8	8	2

Table 4: Resource Leveling Example

It can been seen in the previous example that starting in week 4 you will need 11 staff, then you would have 6 staff in weeks 9 and 10, and back up to 10 staff in weeks 11,12, and 13. This can be smoothed out to alleviate these up and downs by trial and error, but knowing how you are going to staff the project and when you need these staff will be critical to the management of the DRP. A general rules of thumb for resource time on a DRP are as follows:

Field Assessment (Minus drive time)/project	1 hour
Data gathering from operator or municipality (max of 20 projects municipality	1 week
Preliminary analysis of improvement for damaged infrastructure/ project	1 day
Cost estimate of improvement and report/project	1 day

Optimize tradeoffs

"In good project management it is almost always necessary to give up something highly desired to achieve an optimum result." (Harvard Business School, 1996). Trade is almost always necessary in a DRP because everything is seen as high priority. A saying used in business and government is "When everything is a priority, nothing is a priority". This is clear because when everything is at the top and must be done right away, nothing gets done. A good DRP Manager knows this and must be able to prioritize. A key action that must be done in optimizing the tradeoffs includes analyzing the entire project plan and creating several "what if" scenarios. For the recovery process to be successful, coordination and tradeoffs must be done to priorities most critical for the affected community.

The problem exists in DRP because when disaster strikes, every community wants to know when you are going to be able to assess the damage and get them back operational as quickly as possible. The best way to handle this is to get with elected officials, public works directors, city engineers, and city staff to assess the extent of the damages before field

assessment begins. A hotline and website can be established that lets community officials/staff report their damages. The DRP Project Manager can also let the community do a self assessment to mark priorities; those that need to be put back on-line to sustain life and prevent future injuries need to be placed first. These could be water and wastewater treatment facilities, power to key facilities such as fire, police and hospitals, etc.

Every DRP is different, but one task that is consistent among all is to get your Public Campaign underway as quickly as possible. Communication must be the foundational element in a DRP and the Project Manager must be in constant and close contact with elected officials/key staff of the impacted communities to get a real understanding of the extent of the damages. This can be done regionally or on a county-wide basis and could be completed on a two meetings per day schedule; one meeting in the morning in one community and another meeting in the afternoon in the neighboring community. This will allow you to get a handle on 14 communities (7 days @ 2 meetings/day) or 28 communities if you have two Public Relations teams in a weeks' time. After this is complete, a project plan can be finalized and tradeoffs between the different communities can be completed.

Executing Process Group

The Executing Process Group consists of the processes used to complete the work defined in the project management plan to accomplish the project's requirements (Project Management Institute, 2004). This is the step where the actual work gets done. In managing the execution, the DRP Project Manager must:

- Launch the project
- Evaluate project progress
- Update cost and schedule estimates
- Plan and take adaptive action
- Control Change

Launch the project

This is the official start of the project execution and is usually completed with a Project Kickoff Meeting. The Project Kickoff meeting must have in attendance:

- The entire project team
- Alliance Partners
- The Project Sponsor
- Key stakeholders, such as the Client (Local, State, Federal government, or Private Entity) paying the bill
- Senior management

In the Project Kickoff Meeting, the DRP Project Manager must introduce each member by name and task. It should also be made clear that everyone who contributes to the project is part of the team, not just the core management group. In the Kickoff meeting, the Project Manager must explain and get a consensus understanding of the Goal, Deliverable and Schedule of the project that was determined in the Planning Phase of the Project. Understanding the business case of the project of providing disaster recovery services is an important and integral function to get these communities back operational must be a key objective during the kickoff meeting.

Evaluate the project progress

Too often in a project after the plan is complete, project management typically ceases with the impulse of just getting the work done. A DRP is no different, in fact, even more so. Timelines are compressed so drastically that all that is thought of is how the team can complete the work in the quickest way possible. "An inability to control a project diminishes a team's authority and status. Conversely, tracking and managing enhances control over a project and, thereby, the status and authority of the project management and team member" (Harvard Business School, 1996). It is key in a DRP, the Project Manager needs to always track the schedule and budget, open issues, risk, and project specific performance metrics. The elected

officials, public works directors, city engineers, and other key staff need to also know certain metrics.

Update cost and schedule estimates

When planning a DRP, the initial plan is based on historical data and experience of other disaster. This is good start, but cost and schedule estimates need to be revisited once the project is underway because all disasters are different. Thus, as the project progresses, the estimates and assumptions will be improved upon. Some approaches that are outlined in PMBOK include the EAC or Estimated Cost at Completion. This approach can be used to estimate budget and schedule and is defined as:

EAC=ACWP+WR

where:

ACWP=Actual Cost of Work Performed

WR=Budgeted Cost of the Work Remaining

WR=BAC-BCWP

where:

BAC=Budgeted Cost at Completion (The sum of the budgeted cost of the work remaining)

BCWP=Earned Value = EV=The value of work performed expressed in terms of the approved budget assigned to that work for a WBS component

To revise the estimates for both budgets and schedule, the PM can use actual cost and task times to improve the estimate for the remainder of the project. The formula as outlined in PMBOK is:

EAC=ACWP+WR (ACWP/BCWP)

where:

BCWP=Budgeted Cost of Work Performed

Plan and take adaptive action

All the best planning can occur in a DRP, but that doesn't stop the project from getting off track. DRP are complex and as mentioned no two disasters are alike. Thus, when the DRP is off track, we can:

- Accept the deviation
- Revise the plan to reflect the deviation
- Take adaptive action to get back on target.

Thus, once the deviation is accepted and the plan is revised to reflect the deviation, adaptive action must be taken to get the project back on track. Some adaptive actions that could be done include:

- Adjusting the project scope to eliminate one or more deliverables
- Develop alternative methods to perform task
- Alter precedence relationships
- Change resource allocations

Monitoring and Controlling Process Group

The Monitoring and Controlling Process Group consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project (Project Management Institute, 2004). This is where you create the tracking system for the work, look for problems and fix the problems before they derail the project.

Develop testing criteria and procedures

Monitoring a disaster recovery project entails testing and evaluating the disaster recovery plan periodically, preferably annually, to allow for a continuity of municipal operation and the availability of critical resources in the event of the disaster. A deliverable from the DRP should include testing procedures for the disaster recovery plan. These tests will provide the municipality with the assurance that all necessary steps are included in the plan and nothing is missing or unnecessary in the plan. Other reasons to test include:

- Determining the feasibility and compatibility of backup facilities and procedures
- Identifying areas in the plan that need modification
- Providing training to managers and staff
- Demonstrate the ability of the municipality to recover
- Provide motivation for maintaining and updating the DRP

(Wold, 1997)

Some key items that should be tested annually include:

- Backup systems (water, power, etc.) for critical infrastructure. Critical infrastructure would be those that the municipality cannot do without including water and wastewater services and major thoroughfare access.
- Documentation of key personnel that will need to be present during and immediately after the disaster. This could include the City Manager, Public Works Director, Superintendent of W/WW facility, etc.
- Communications equipment
- Emergency Generators

Closing Process Group

The Closing Process Group includes the processes used to formally terminate all activities of a project or a project phase, hand off the completed product to others or close a

cancelled project (Project Management Institute, 2004). This is the step when you submit your deliverable, fill out all of your final paperwork and submit any final invoices.

Chapter 4: Project Results

A DRP is a unique project because you need to determine project eligibility, what types of projects you are going to evaluate (housing, non-housing, economic development) and which region(s) will you evaluate. You must clearly state your project objective in your opening project documents. Such as, "This project summarizes the finding of infrastructure damages resulting from Hurricane John covering a 10 County Area."

THE PROJECTS: ELIGIBILITY TYPES AND COSTS

Most DRP will involve various facility and project types. The projects need to be checked against the eligibility criteria determined by the municipal client, state, federal government, and the project team. After the project is deemed eligible, it can be assessed, scoped, and estimated to replace the damages.

Eligibility

Over the course of a program, a community is going to request technical assistance far beyond the reach of the individual program unless given the objectives upfront. It must be clear which project will be eligible and which project will not be eligible before assessment to avoid any confusion later on. A general criterion for eligible activities and projects include:

- Is the damage attributed to the Hurricane under analysis?
- Did the infrastructure fail to function due to the Hurricane under analysis?
- Does the project fall under the list of project types eligible for assessment (See Appendix 2)

As a result of this eligibility evaluation, potential outcomes could include:

- Ineligible based on an office review of the scope. An example would be the facility is not used in a manner outlined by the contracting entity for the projects
- Ineligible based on a field assessment
- Withdrawn from assessment based on a community request
- Incorporated into or combined with other projects

Types

Types of eligible infrastructure projects range widely as seen in Appendix 2. Eligible projects are general grouped into these nine facility types:

- **Water**: includes all infrastructure dealing with water production, treatment, and delivery, including but not limited to the pipelines, treatment plants, wells, and pump stations.
- **Wastewater**: includes collection, treatment, pumping storage, distribution, and studies including but not limited to gravity lines, force mains, treatment plants and lift stations.
- **Drainage**: include all infrastructure dealing with stormwater management such as ditches, culverts, stormwater pipeline systems, water detention/retention ponds, levees or dikes, floodwalls, bulkheads, general drainage improvements, and drainage improvement studies.
- **Buildings**: includes publicly owned building such as City or County Departments, Fire Stations, Police Stations, Libraries, Call Centers, Emergency Operation Centers, Community Centers, Etc.
- **Transportation**: includes route and widening studies, bridges, roads, traffic signals, and traffic signs.
- **Equipment**: include communication equipment, emergency response equipment, publicly owned vehicles, etc.
- **Generators**: include the repair, replacement or acquisition of power critical to infrastructure such as lift stations, fire and police stations, water and wastewater plans, and other facilities necessary during an emergency.
- **Debris Removal**: includes removal of debris that occurred immediately following the storm.

- **Park and Recreational Facilities** include all auxiliary subsets of parks, including fencing, tables, pavilions, playgrounds, etc.
- **Other infrastructure**: Includes items such as exterior features of public facilities, public alert systems, environmental samplers, development of certain emergency focused education programs and any other element not covered by the other Critical Infrastructure subcategories.

Generally, the scope of work for most DRP include construction activities, associated engineering and right-of-way costs. However, depending on how much of the upfront work is already completed, a scope can only include the planning or engineering study with the assumption that more scoping must be done after to determine the associated construction cost.

Costs

The estimated project costs can be summarized using several methods. The method that is best for one community may not be applicable for another. The cost summary must be clear and concise enough to let the community determines its priority projects and come up with a method of distribution that is fair and can be easily traced.

A cost summary that is typical for DRP would be to summarize the cost based on projects within Council of Governments (COGs), Counties, or Cities. Another cost summary that is typically needed is the estimated costs by facility type. Thus, a graph table showing the dollars spent for water, wastewater, drainage, buildings, transportation, equipment, generators, debris removal, park and recreational facilities, and other infrastructure would give an indication of which infrastructure type received the most damages and where priorities should be given.

DAMAGE TRENDS

Facilities impacted by Hurricanes range widely in type, size and location. Damage or failure to function for these facilities is mainly attributed to wind, rainfall, or storm surge. The following is a summary stating damage trend by facility type.

Building facilities included various types such as police stations, fire stations, libraries, points of distributions (PODs), and others. Damage trends include:

- Failure to operate as a shelter or POD due to power outages
- Material damage due to flooding or impact of debris
- Material loss due to wind or flooding
- Structural failure due to wind or flooding
- Corrosion of equipment due to saltwater intrusion.

Drainage facilities included ditches, channels, ponds, levees, seawalls, bulkheads, and others. Damage trends include:

- Capacity reduction caused by siltation, debris, or damage
- Flooding due to insufficient drainage capacity to handle runoff
- Material loss or material damage of conveyance or storage structures
- Salt water intrusion into fresh water facilities
- Washout of coastal protection measures such as dunes, sand and berms
- Siltation of navigation waterways

Transportation facilities included various types such as road, bridges, signals, signs and others. Damage trends include:

- Material failure due to unusual loading by heavy equipment used for recovery efforts
- Pavement material loss due to flooding and undermining
- Bridge material loss and damage due to debris impact and scour
- Material deterioration due to submergence for extended periods
- Signal and sign material loss, damage and deformation due to wind speeds.

Water and Wastewater facilities included various types such as sanitary sewer lift stations, treatment plants, water wells, water storage and others. Damage trends include:

- Failure to operate plants, wells, and pumps due to power outages
- Failure to operate equipment and controls due to flooding or water submergence
- Corrosion of equipment and controls due to flooding and saltwater intrusion
- Damage or loss of material due to wind, debris impact or flooding
- Mix of water runoff and sewage (inflow and infiltration) due to heavy/extended runoff
- Sewage overflow due to insufficient capacity or failure to function
- Structural failure or washout of systems due to storm surge
- Failure of systems due to failure of supporting systems (roads, bridges, etc.)

PROJECT MANAGEMENT PROCESS FOR FUTURE EVENTS

For successful recovery to occur, communities need to have a clear, concise and timely recovery plan. This plan with a project management process outlined within this report will ultimately lead to successful disaster recovery. Communication must be paramount with all stakeholders to allow the municipality to get out all facets of the recovery progress. Periodically, publishing the progress information on-line and to the media will mitigate and possibly avoid entirely any negative feelings to the process.

Appendices

Appendix A - Project Types

TYPE OF PROJECT	EXAMPLE
Transportation	
Transportation Study	Insufficient capacity for evacuation, other failure resulting in a re-evaluation of the system in order to develop an appropriate design. TxDOT system projects are NOT eligible. Portion of a full roadway system destroyed – evaluation needed to assess what needs to be replaced. Studies may result in additional projects that will be defined later and can be eligible for additional application under subsequent funding allocations.
Road	Subgrade, base, or surface failure. May have a drainage component creating this issue. Damage could have resulted from being submerged, flooding, or emergency equipment load. Submerged roads criteria – If a road has been submerged for a period of 24 hours or greater, there is a high probability that it has suffered significant damage that will result in a failure of the roadway. This damage may not currently be evident. This project should be assessed visually with special consideration of the impacts of being submerged – determine the linear limits of submergence and the time frame – assess completely.

Appendix A – Project Types

TYPE OF PROJECT	EXAMPLE
Drainage	
Bridge or Culvert (i.e., Box Culvert, Bridge Culvert)	Bridge structure can be improved to withstand future storm (wood to concrete, design of structure, etc.) if it was damaged by the hurricane.
Intersection	See Road and Traffic Signal. Barrier during evacuation (on evacuation route)
Sign	Damaged, destroyed
Railroad Crossing	Damaged, destroyed
Drainage Study	Need to study area/system drainage needs and problems in order to properly design projects. This would apply to a network of ditches, channels, pipe network if they flooded during the hurricane. Studies may result in additional projects that will be defined later and can be eligible for additional application under subsequent funding allocations. Individual projects may need preliminary engineering for a traditional design project – NOTE this under the design project
Storm Sewer System	Damaged, destroyed, or failed to function as designed. May require preliminary engineering.
Drainage Channel	Damaged, destroyed, or failed to function as designed.
Detention/Retention Facility	Needed to mitigate flooding, debris.
Coastal Restoration	Erosion, destruction of existing erosion-prevention material, improvement to harden existing system
Buy-out	Buy-outs of homes, businesses, property resulting from flooding only on a case-by-case basis where HMGP not an option.
Floodwall or Seawall	This includes a seawall to armor the coast line or a floodwall that would act as a barrier. Include levees here and note appropriately.

Appendix A – Project Types

TYPE OF PROJECT	EXAMPLE
Building Facilities	
Shelter	For citizens and/or emergency personnel's families, need generator
Health/Medical Center	Damaged/destroyed, need generator
Library	Damaged/destroyed (no generator unless serving alternate eligible purpose)
Community Center	Damaged/destroyed, need generator if used as a shelter
Public Works Building	Eligible for damage/destroyed, need generator if used as a shelter.
Fire Station, Police Station	Damaged/destroyed, need generator
"Pro-rated" facility shared with government facility	If one of the above facilities is shared with a government facility (city hall, county courthouse), then the amount dedicated to the "eligible" facility will be funded at a prorated portion. Sharing might be reflected by the amount of area/square footage for dedicated areas; or if a single room/building is used for multiple purposes, consider the amount of time that is dedicated for each purpose. Use judgment based on input from the community.

Appendix A – Project Types

TYPE OF PROJECT	EXAMPLE
Water/Wastewater	
Water Supply Study	System failed to function or did not exist and requires a study to determine appropriate improvements. System was insufficient in capacity, age, design, networking, communication, instrumentation, etc. Consider all appropriate components that may have failed to function: water supply (well, surface reservoir, wholesale from regional supply), ground storage, elevated storage, booster pump stations (with generator and/or water hammer suppression devices), treatment, transmission mains, distribution piping, SCADA or other integrated communication. Studies may result in additional projects that will be defined later and can be eligible for additional application under subsequent funding allocations.
Water/Wastewater Distribution/Collection Study	System failed to function and requires a study to determine appropriate improvements. System was insufficient in capacity, age, design, networking, communication, instrumentation, etc. Consider all appropriate components that may have failed to function: collection system (consider flood plain implications of I&I that could overload the system), lift stations, force mains, treatment. Studies may result in additional projects that will be defined later and can be eligible for additional application under subsequent funding allocations.

Appendix A – Project Types

TYPE OF PROJECT	EXAMPLE
Water/Wastewater (cont.)	
	Component may be old, small, and obsolete. Need to regionalize and purchase wholesale from a regional supplier if also damaged or failed to function as designed. Studies may result in additional projects that will be defined later and can be eligible for additional application under subsequent funding allocations
Water Distribution	Damaged during the hurricane (breaks), insufficient to function properly (pressure, flow) during storm. No service existed for fire fighting.
Pump Station	Damaged/destroyed; needs to be raised out of floodplain; Install permanent emergency generator; Improper instrumentation/ controls to operate during emergency; was insufficient in capacity, age, type to operate during emergency and serve community needs; Water hammer issues during power failure caused damage. If new pumps/ motors are required, high-efficiency models will be recommended for installation above floodplain.
Water Well	Damaged, destroyed, or needs generator due to power loss.
Water Supply Reservoir	Could have been placed out of order due to inflow of seawater; need barrier wall; need improvements to function properly.
Elevated Water Storage	Damaged/destroyed. Failed to operate properly (pump failure, communication/ SCADA failure, flooding, inadequate piping system, pressure problems)

TYPE OF PROJECT	EXAMPLE
Water/Wastewater (cont.)	
Ground Water Storage	Damaged/destroyed. Failed to operate properly – pump failure, communication/ SCADA failure, flooding, inadequate piping system, pressure problems, pump/ motor size, type, or elevation (need to raise) problems; lost power (generator).
Water Treatment Plant	Submerged or flooded, instrumentation control failure, communication failure with other system components (SCADA), treatment technology is out of date/code and failed to function properly, damage to any component. lost power (generator).
Wastewater Collection	Damaged during The hurricane (breaks), was insufficient to function properly (flow) during storm due to size, age, etc. Consider manhole failure and would tighter connections have helped the system from overloading due to storm surge
Wastewater Treatment Plant	Submerged or flooded, instrumentation/ control failure, communication failure with other system components (SCADA) failed to function properly, damage to any component.
Lift Station	Damaged/destroyed. Needs to be raised out of floodplain; lost power and needs emergency generator; Improper instrumentation/ controls to operate during emergency; Insufficient in capacity, age, type to operate during emergency and serve community needs. If new pumps/ motors are required, high-efficiency models will be recommended. May need submersible pumps for a lift station to avoid flooding/ failure or may determine need to raise pumps.
Electrical – No separate Project Assessment Data Sheet, use one of the above	
Service Restoration	See above for systems (water, wastewater, drainage pump station)
Backup Generator	See above for systems (water, wastewater, drainage pump station) IMPORTANT NOTE ON GENERATORS – Generators cannot be portable. All equipment eligible for HUD funds must be permanent and fixed.

Appendix B- Eligible Project Types

The following is a list of project types that are eligible for assessment:

Transportation
□Transportation Study
□Road
□Bridge
□Traffic Signal
□Intersection
□Sign
□Railroad Crossing Signal Upgrade
□Railroad Crossing

Drainage
□Drainage Study
□Storm sewer System
□Drainage Channel
□Culvert
□Detention/Retention Facility
□Coastal Restoration
□Buy-out
□Floodwall

Building Facilities
□Shelter
□Health/Medical Center
□Library
□Community Center
□Fire Station

Water/Wastewater
□Water Supply Study\
□W/WW Distribution/Collection Study
□WW Regionalization Study
□Water Distribution
□Pump Station
□Water Well
□Water Supply Reservoir
□Elevated Water Storage
□Ground Water Storage
□Water Treatment Plant
□Wastewater Collection
□Wastewater Treatment Plant
□Lift Station

Electrical (USE BUILDING OR WATER/WASTEWATER DATA SHEETS)
□Service Restoration
□Backup Generator

The following is a list of project types that are NOT eligible for assessment at this time:

Communication
□Fiber Optic
□Wireless
□Community Alert System
□Radio Systems

Glossary

CDBG Community Development Block Grant

COG Council of Governments

DHS Department of Homeland Security

DRP Disaster Recovery Project

EA Environmental Assessment

FEMA Federal Emergency Management Agency

FHWA Federal Highway Administration

GDEM Governor's Division of Emergency Management

GIS Geographic Information System

GPS Global Positioning System

HMGP Hazard Mitigation Grant Program

HUD U.S. Department of Housing and Urban Development

IA Individual Assistance

kW Kilowatt

NFIP National Flood Insurance Program

NOAA National Oceanic and Atmospheric Administration

ORCA Office of Rural Community Affairs

PA Public Assistance

PDA Preliminary Damage Assessment

POD Point of Distribution

PW Project Worksheet

QA Quality Assurance

QC Quality Control

ROW Right-of-Way

RPA Request for Public Assistance

SDE Substantial Damage Estimator

TCEQ Texas Commission on Environmental Quality

TDHCA
Texas Department of Housing and Community Affairs

TDRA Texas Department of Rural Affairs (formally Office of Rural Community Affairs of ORCA - effective September 1, 2009)

TWDB Texas Water Development Board

USFWS
U.S. Fish and Wildlife Service

USGS U.S. Geological Survey

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Vita

Steven Gonzales led a team of 26 infrastructure engineers in Southeast Texas after Hurricane Ike made landfall in September 2008. His direction from December 2008 to May 2009 led to over 3000 infrastructure projects being identified in the field.

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